



Comparing distributed execution traces for understanding intermittent latency sources

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Challenges

- Challenges in troubleshooting.
 - Explosion in the number of service instances.
 - Complex dependencies.
 - Different infrastructures.
 - Different configurations.
 - Define problems related to intra-service communication or Inter-service.

- Local problem
 - ❖ Bad code
- System problem
 - ❖ System misconfiguration

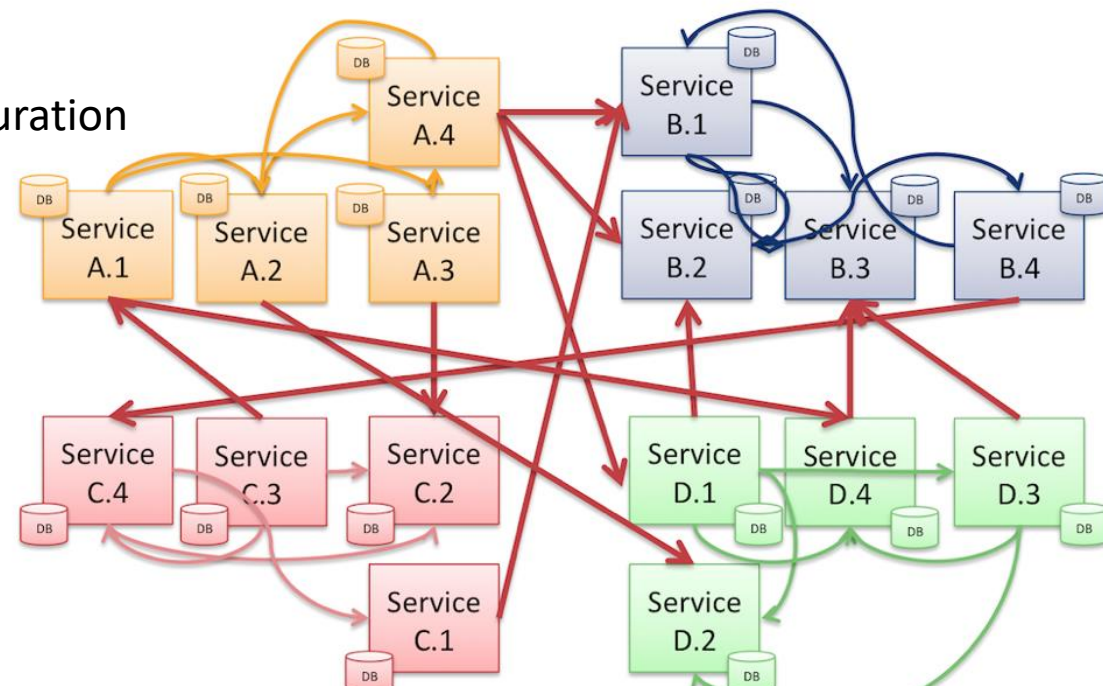


Image reference:
http://techbeacon.com/sites/default/files/microservices_0.png

Motivation

- Help users understand what is happening when something is different
 - Performance differences between versions of the application.
 - Performance differences between system configurations.
 - Why some requests are slower than others?

Roadmap

1. End-to-end trace collection (user/kernel level) across many service instances.
2. Extend TraceCompass to analyze micro-services.
 - Extracting spans and their associated kernel events.
 - Calculating performance metrics related to each span.
3. Comparing similar requests for detecting performance issues.
4. Latency issue localization.

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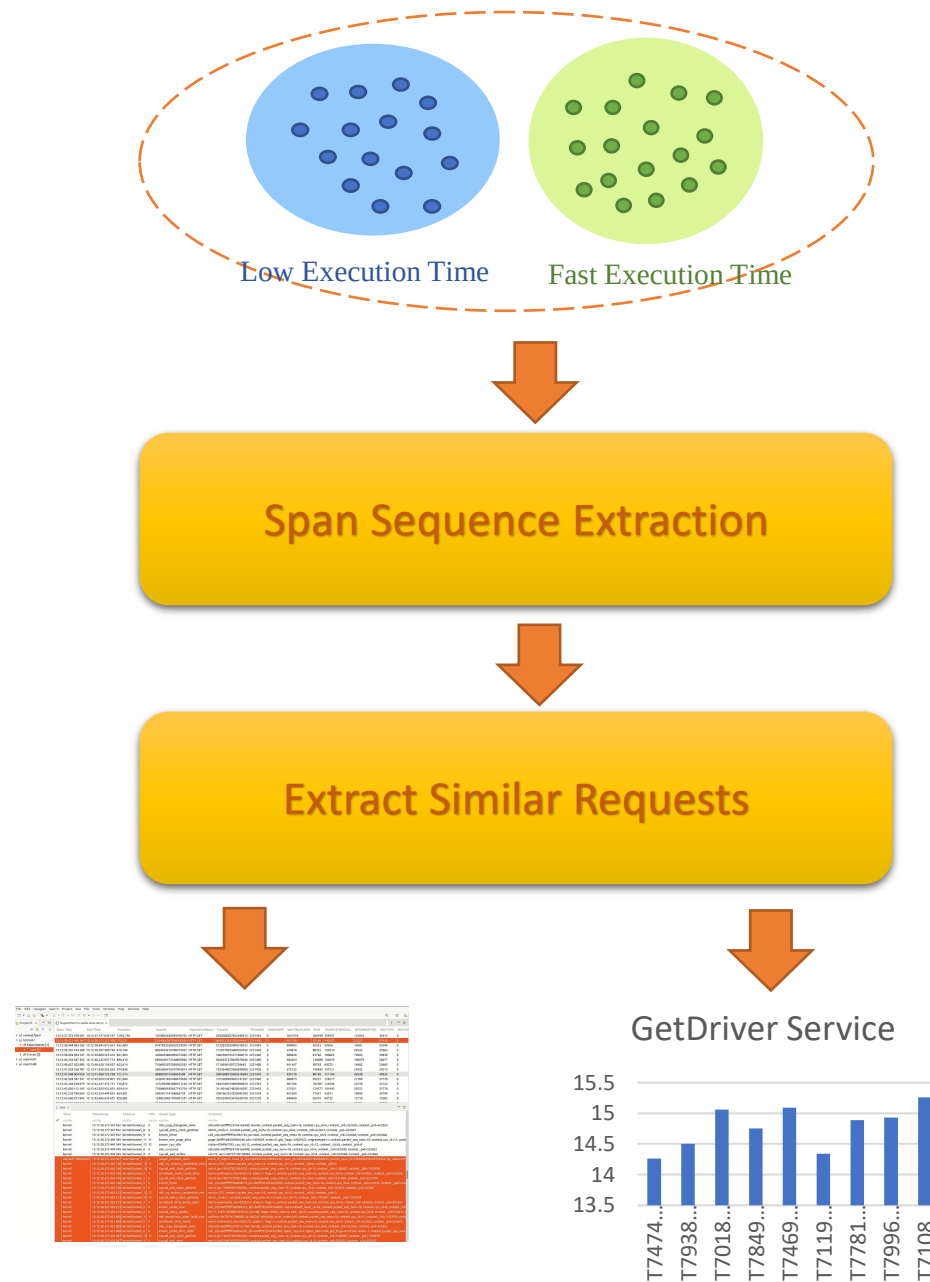
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2. Extend Trace Compass to analyze micro-services. (Accomplished)
 - Extracting spans and their associated kernel events.
 - Calculating performance metrics related to each span.
3. Comparing similar requests for detecting performance issues. (In progress)
4. Latency issue localization. (In progress)

Accomplished



Demo!

Demo

booking: A 57b2355

11 Spans

booking (11)

Today 12:44:13 pm
4 hours ago

booking: A 29c179e

11 Spans

booking (11)

Today 12:41:36 pm
4 hours ago

booking: A f141428

11 Spans

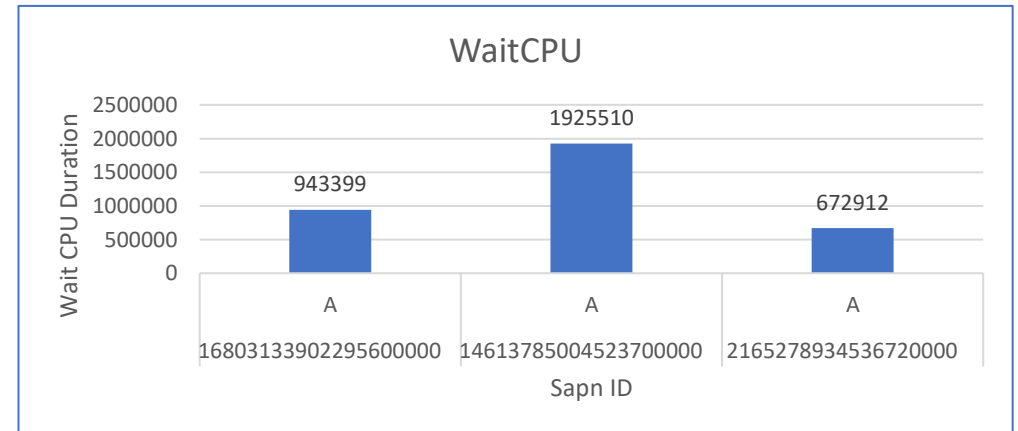
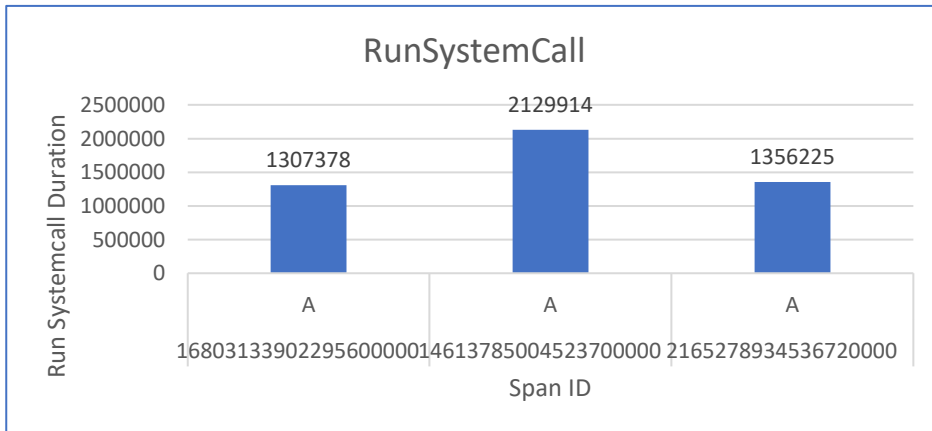
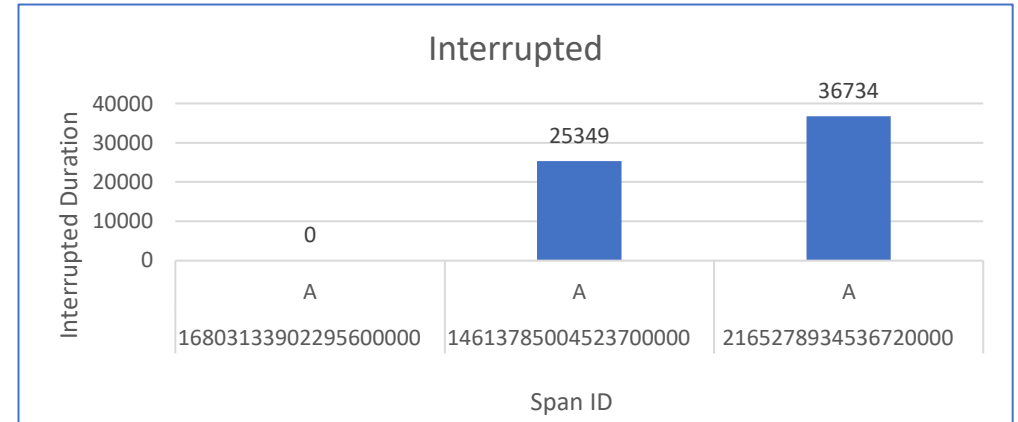
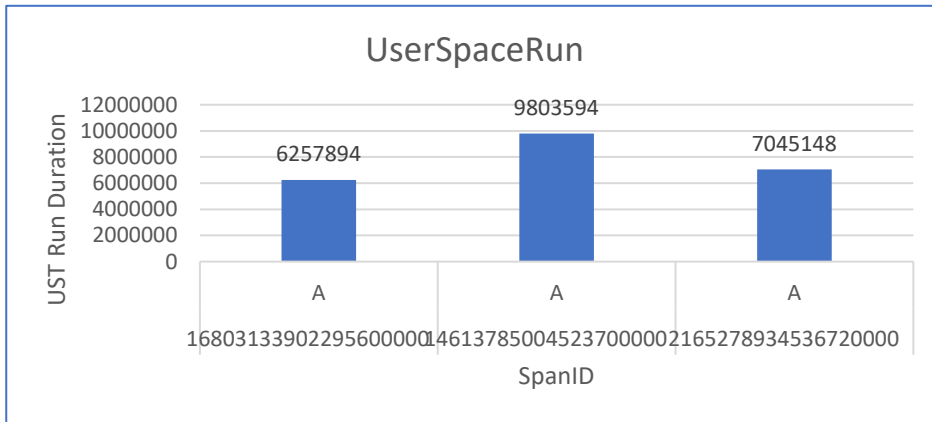
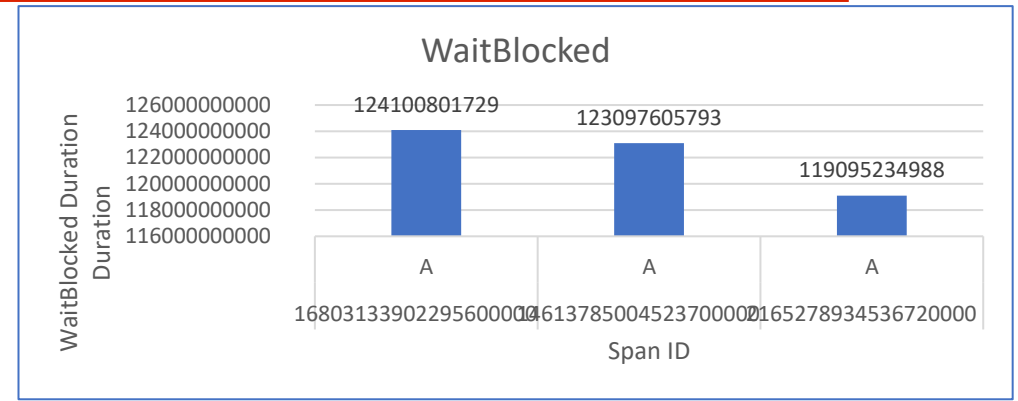
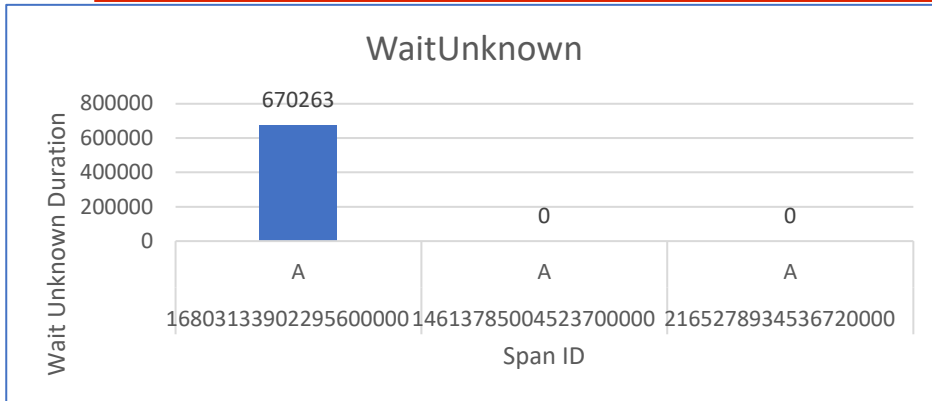
booking (11)

Today 12:39:15 pm
4 hours ago

%spanMetrics.table.view.name													
End Time	Duration	SpanId	Op	TraceID	ThreadID	UI	WAITBLOCKED	RUN	RUNSYSTE	INTERR	WAITCPU	WAITUNKNOV	
12:41:19.967 914 185	124,110,086,367	16803133902295575273	A	17384249196170543119	427949	0	124100801729	6257894	1307378	0	943399	670263	
12:46:16.410 367 142	123,112,033,850	14613785004523707452	A	6319171875148446552	428148	0	123097605793	9803594	2129914	25349	1925510	0	
12:43:35.885 645 749	119,105,007,895	2165278934536722865	A	3008820097644236250	428029	0	119095234988	7045148	1356225	36734	672912	0	
12:41:19.967 854 610	69,058,121,605	7779924224627721271	D	17384249196170543119	427949	0	69053556565	2725632	512489	0	612220	670263	
12:43:35.884 995 177	64,053,854,915	2474071060174821467	D	3008820097644236250	428029	0	64049232042	3287785	658322	0	367082	0	
12:46:16.409 940 271	62,045,840,673	17113697123886644621	D	6319171875148446552	428148	0	62038285152	4764003	1082317	0	1319294	0	
12:45:14.363 774 207	60,062,617,888	5905860109768889705	C	6319171875148446552	428148	0	60057934741	3073110	690604	16481	445653	0	
12:46:16.409 405 566	60,042,054,485	1338904997953990571	H	6319171875148446552	428148	0	60035894677	3698038	836494	0	1179612	0	
12:45:14.363 431 566	55,056,087,669	8835333125383099038	E	6319171875148446552	428148	0	55052592663	2442867	603450	16481	317984	0	
12:41:19.967 530 407	52,052,413,218	6300958417020111788	H	17384249196170543119	427949	0	52048931696	2035198	374569	0	486020	450265	

python-workload					
Trace	Timestamp	Channel	CPU	Event type	Contents
<srch>	<srch>	<srch>	<srch>	<srch>	<srch>
kernel	12:39:15.857 800 230	kernelchannel_1	1	syscall_exit_clock_gettime	ret=0, tp=140502471981712, context.packet_seq_num=8, context.cpu_id=
kernel	12:39:15.857 801 697	kernelchannel_1	1	syscall_entry_clock_gettime	which_clock=1, context.packet_seq_num=8, context.cpu_id=1, context_tid=
kernel	12:39:15.857 801 697	kernelchannel_8	8	syscall_entry_clock_gettime	which_clock=0, context.packet_seq_num=13, context.cpu_id=8, context_tid=
kernel	12:39:15.857 804 072	kernelchannel_1	1	syscall_exit_clock_gettime	ret=0, tp=93918609239680, context.packet_seq_num=8, context.cpu_id=1
kernel	12:39:15.857 804 072	kernelchannel_8	8	syscall_exit_clock_gettime	ret=0, tp=140729904619488, context.packet_seq_num=13, context.cpu_id=
kernel	12:39:15.857 812 592	kernelchannel_8	8	syscall_entry_getpid	context.packet_seq_num=13, context.cpu_id=8, context_tid=427949, conl
kernel	12:39:15.857 813 989	kernelchannel_8	8	syscall_exit_getpid	ret=427949, context.packet_seq_num=13, context.cpu_id=8, context_tid=
kernel	12:39:15.857 826 840	kernelchannel_8	8	syscall_entry_clock_gettime	which_clock=1, context.packet_seq_num=13, context.cpu_id=8, context_tid=
ust/uid/1000/64-bit	12:39:15.857 827 818	ltng_python_channel_8	8	ltng_python:event	asctime=2022-12-06 12:39:15.857, msg=operation_name=A,parent_id=N
kernel	12:39:15.857 829 284	kernelchannel_8	8	syscall_exit_clock_gettime	ret=0, tp=140729904617216, context.packet_seq_num=13, context.cpu_id=
kernel	12:39:15.857 856 871	kernelchannel_8	8	kmem_mm_page_alloc	page=0xfffff59580517c00, pfn=83440, order=0, gfp_flags=17829322, migr
kernel	12:39:15.857 866 510	kernelchannel_8	8	syscall_entry_clock_gettime	which_clock=0, context.packet_seq_num=13, context.cpu_id=8, context_tid=
kernel	12:39:15.857 868 884	kernelchannel_8	8	syscall_exit_clock_gettime	ret=0, tp=140729904621184, context.packet_seq_num=13, context.cpu_id=
kernel	12:39:15.857 873 075	kernelchannel_0	0	syscall_entry_clock_gettime	which_clock=1, context.packet_seq_num=18, context.cpu_id=0, context_tid=
kernel	12:39:15.857 875 938	kernelchannel_0	0	syscall_exit_clock_gettime	ret=0, tp=93918609239056, context.packet_seq_num=18, context.cpu_id=

Demo



Real Use Case

Your web client's id: 6091

Hot R.O.D.

 Rides On Demand 

Rachel's Floral Designs

Trom Chocolatier

Japanese Desserts

Amazing Coffee Roasters

Click on customer name above to order a car.

HotROD **T748448C** arriving in 2min [req: 6091-11, latency: 747ms] [\[find trace\]](#)
HotROD **T700500C** arriving in 2min [req: 6091-10, latency: 684ms] [\[find trace\]](#)
HotROD **T744973C** arriving in 2min [req: 6091-9, latency: 784ms] [\[find trace\]](#)
HotROD **T753519C** arriving in 2min [req: 6091-8, latency: 746ms] [\[find trace\]](#)
HotROD **T789561C** arriving in 2min [req: 6091-7, latency: 659ms] [\[find trace\]](#)
HotROD **T743316C** arriving in 3min [req: 6091-6, latency: 614ms] [\[find trace\]](#)
HotROD **T755453C** arriving in 2min [req: 6091-5, latency: 715ms] [\[find trace\]](#)
HotROD **T713129C** arriving in 2min [req: 6091-4, latency: 684ms] [\[find trace\]](#)
HotROD **T741979C** arriving in 2min [req: 6091-3, latency: 718ms] [\[find trace\]](#)
HotROD **T750435C** arriving in 2min [req: 6091-2, latency: 690ms] [\[find trace\]](#)
HotROD **T778534C** arriving in 2min [req: 6091-1, latency: 736ms] [\[find trace\]](#)

Search

JSON File

Service (7)

customer ▾

Operation (1)

all ▾

Tags ⓘ

http.status_code=200 error=true

Lookback

Last Hour ▾

Max Duration

e.g. 1.2s, 100ms, 500us

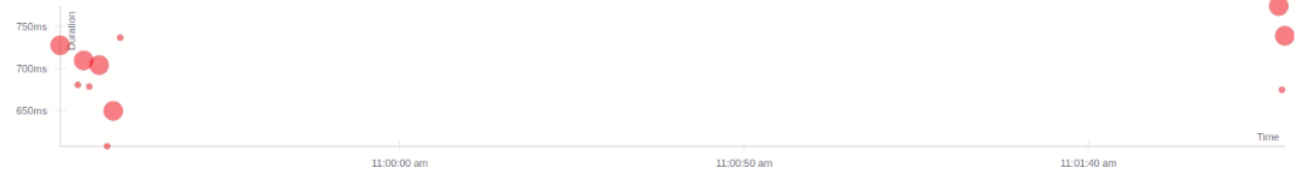
Min Duration

e.g. 1.2s, 100ms, 500us

Limit Results

20

Find Traces



11 Traces

Sort:

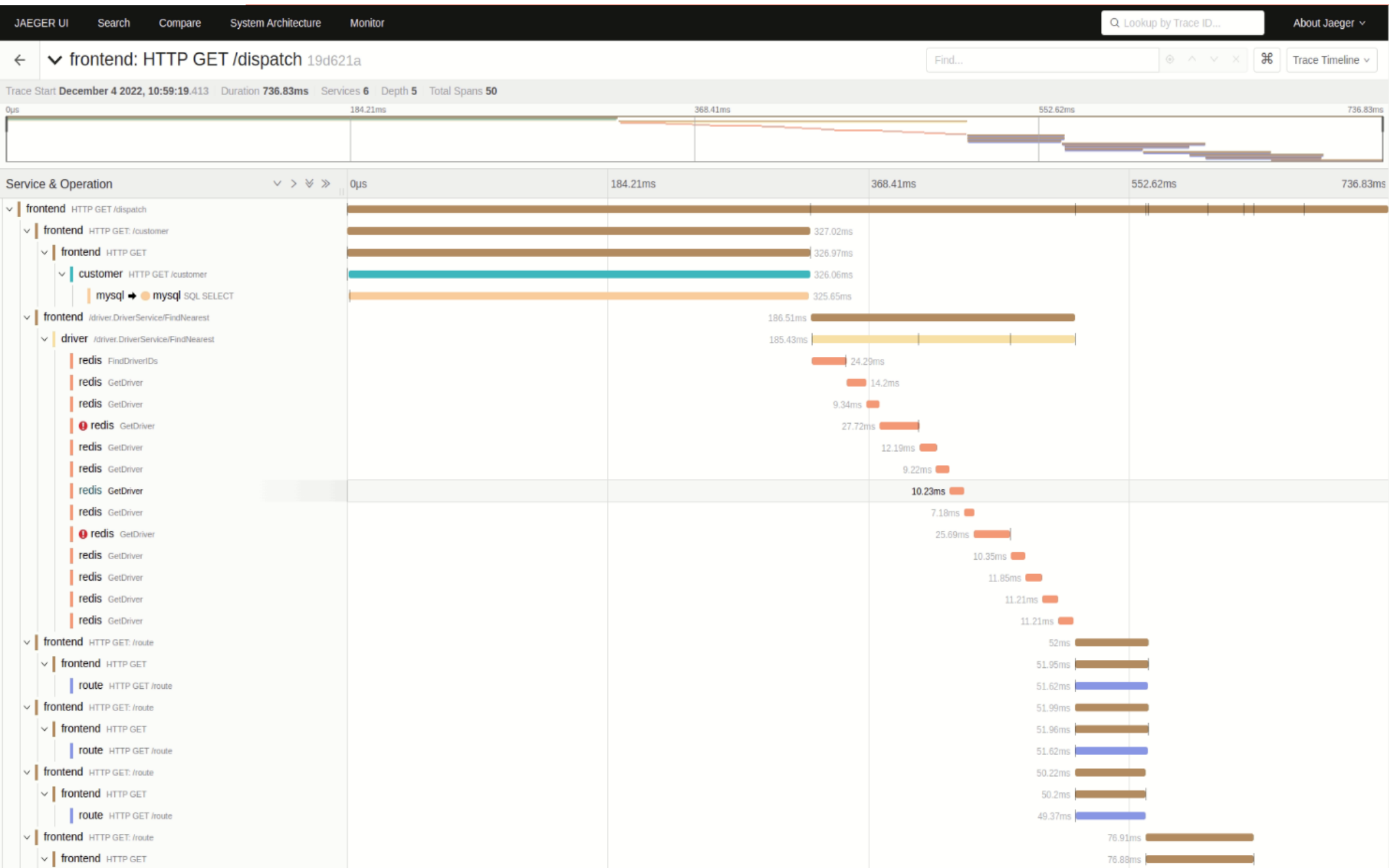
Most Recent ▾

Deep Dependency Graph

Compare traces by selecting result items

☐	frontend: HTTP GET /dispatch 49bec22	739.02ms	
51 Spans	3 Errors	customer (1) driver (1) frontend (24) mysql (1) redis (14) route (10)	Today 11:02:08 am 3 minutes ago
☐	frontend: HTTP GET /dispatch 31fb97b	674.87ms	
50 Spans	2 Errors	customer (1) driver (1) frontend (24) mysql (1) redis (13) route (10)	Today 11:02:08 am 3 minutes ago
☐	frontend: HTTP GET /dispatch 0900a9c	774.49ms	
51 Spans	3 Errors	customer (1) driver (1) frontend (24) mysql (1) redis (14) route (10)	Today 11:02:07 am 3 minutes ago
☐	frontend: HTTP GET /dispatch 19d621a	736.83ms	
50 Spans	2 Errors	customer (1) driver (1) frontend (24) mysql (1) redis (13) route (10)	Today 10:59:19 am 5 minutes ago
☐	frontend: HTTP GET /dispatch 0e9b0aa	649.75ms	
51 Spans	3 Errors	customer (1) driver (1) frontend (24) mysql (1) redis (14) route (10)	Today 10:59:18 am 5 minutes ago

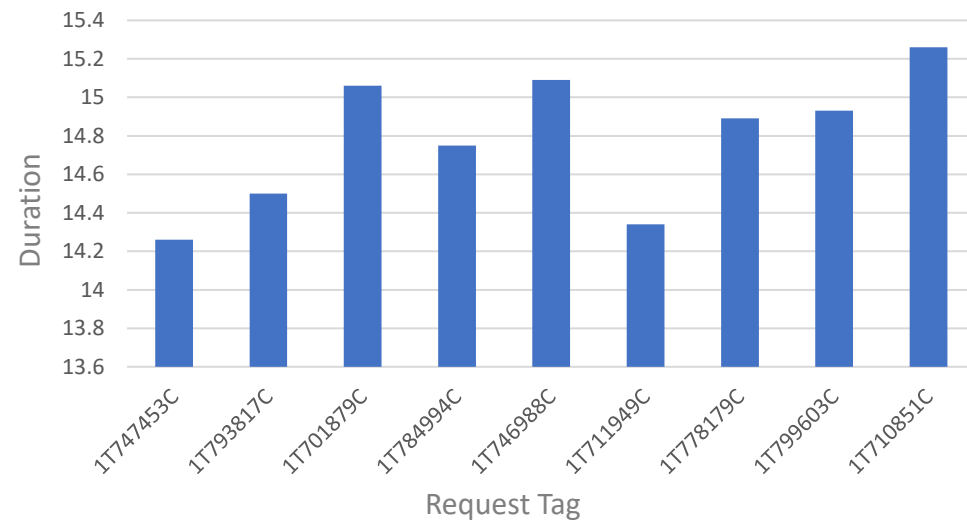
Demo



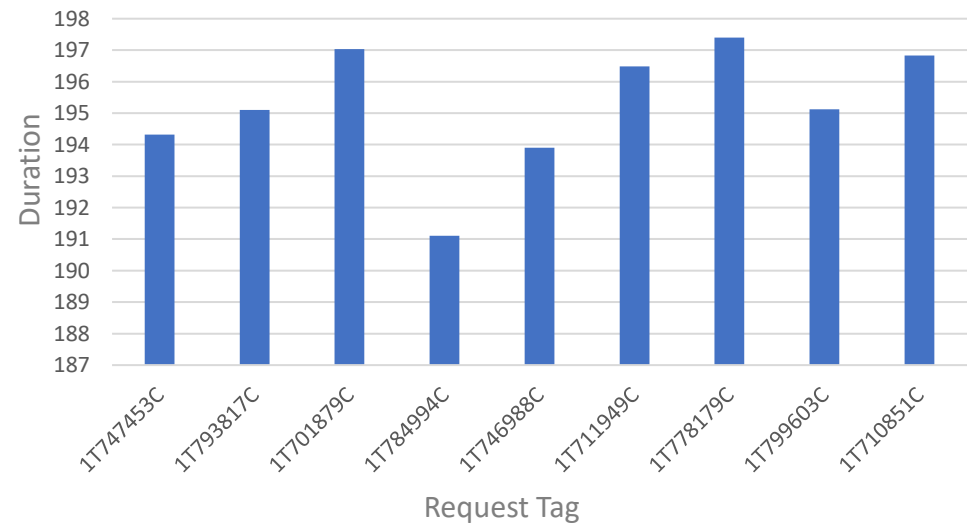
Demo

Duration time for each specific span(service) shared between different requests

GetDriver Service



driver.DriverService/FindNearest



Demo

File Edit Navigate Search Project Run File Tools Window Help Window Help

Project E x %spanMetrics.table.view.name x

Start Time	End Time	Duration	SpanId	OperationName	TraceID	ThreadID	UNKNOWN	WAITBLOCKED	RUN	RUNSYSTEMCALL	INTERRUPTED	WAITCPU	WAITIO
13:12:37.475 190 501	13:12:37.477 034 247	1,843,746	1229892636994790792	HTTP GET	2930386307852640515	2231393	0	1031976	300199	359351	122916	36315	0
13:12:38.372 449 367	13:12:38.373 224 398	775,031	2634666347856030036	HTTP GET	4649323241996644491	2231400	0	497199	92168	140357	21022	31916	0
13:12:38.844 983 242	13:12:38.845 675 651	692,409	674783533020224559	HTTP GET	5132832032095018512	2231403	0	490983	63323	92936	16901	32544	0
13:12:39.307 164 580	13:12:39.307 980 748	816,168	8064454219398722957	HTTP GET	1129776023686054792	2231403	0	554819	88325	120310	20533	35966	0
13:12:39.859 694 147	13:12:39.860 525 610	831,463	4428493826994373362	HTTP GET	1602396195577068779	2231400	0	600426	81766	100822	19904	30939	0
13:12:40.232 047 363	13:12:40.232 937 773	890,410	8856449173168859926	HTTP GET	5046257279649070936	2231400	0	504254	130090	134070	100079	26677	0
13:12:40.627 502 893	13:12:40.628 126 507	623,614	7106055072059302333	HTTP GET	171693610072734642	2231400	0	441467	59763	84275	16482	23465	0
13:12:41.029 530 787	13:12:41.030 505 635	974,848	2805968476767943014	HTTP GET	7253648023506649096	2231403	0	672153	109842	137211	24932	37013	0
13:12:41.668 004 654	13:12:41.668 725 768	721,114	898007072458654509	HTTP GET	2004388735993318384	2231403	0	435110	88185	111160	43930	49934	0
13:12:42.028 587 341	13:12:42.029 539 001	951,660	3430301639468479638	HTTP GET	3153500909645147207	2231400	0	680673	95241	128271	21789	31776	0
13:12:42.436 618 879	13:12:42.437 375 751	756,872	1272994903890551236	HTTP GET	1847040193909890614	2231393	0	481766	102507	124500	22558	32124	0
13:12:42.820 112 162	13:12:42.820 952 076	839,914	7790808930967742754	HTTP GET	3119016674828016287	2231403	0	527651	124577	101942	59222	31776	0
13:12:43.533 784 865	13:12:43.534 449 826	664,961	549341114184066734	HTTP GET	3507663357820045780	2231378	0	457669	71427	93911	19694	30799	0
13:12:43.866 013 993	13:12:43.866 634 675	620,682	1248258451976041241	HTTP GET	2926296703476528199	2231378	0	444469	65701	84132	12710	15503	0

test x

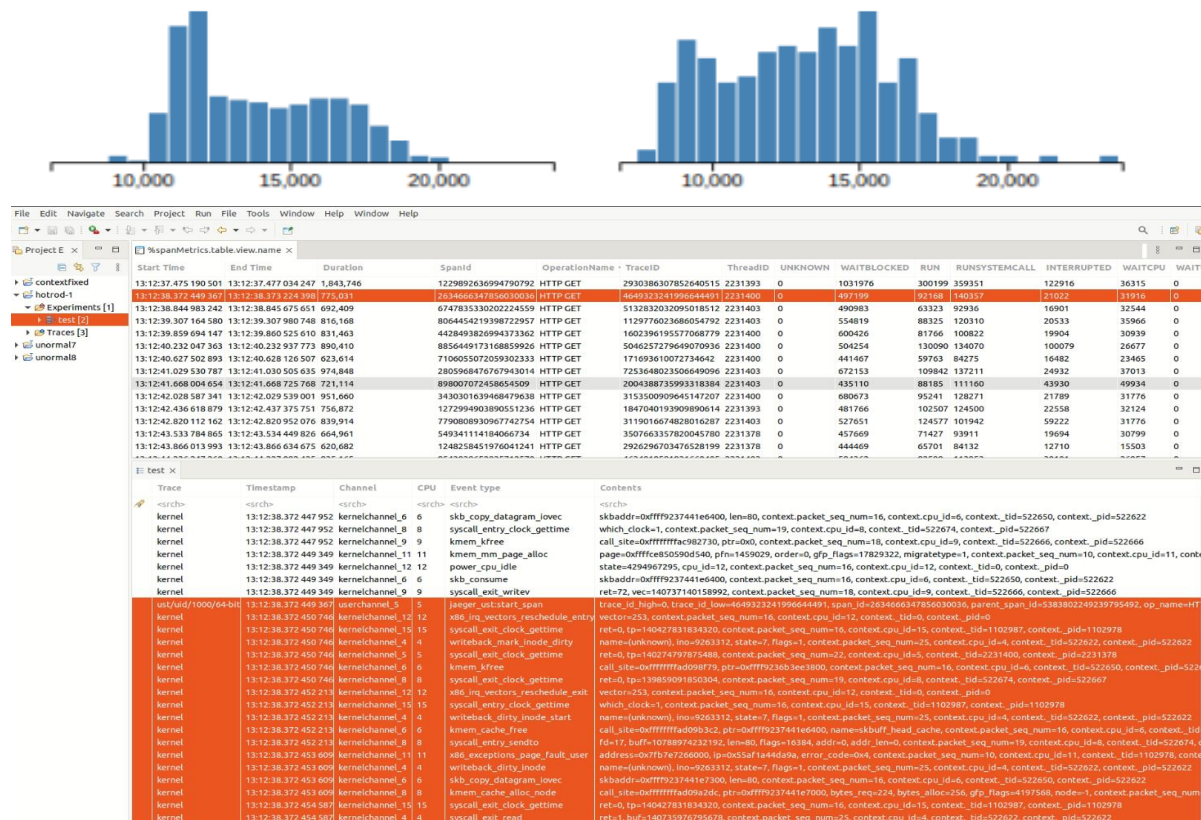
Trace	Timestamp	Channel	CPU	Event type	Contents
<srch>	<srch>	<srch>	<srch>	<srch>	<srch>
kernel	13:12:38.372 447 952	kernelchannel_6	6	skb_copy_datagram_iovec	skbaddr=0xffff9237441e6400, len=80, context.packet_seq_num=16, context.cpu_id=6, context_tid=522650, context_pid=522622
kernel	13:12:38.372 447 952	kernelchannel_8	8	syscall_entry_clock_gettime	which_clock=1, context.packet_seq_num=19, context.cpu_id=8, context_tid=522674, context_pid=522667
kernel	13:12:38.372 447 952	kernelchannel_9	9	kmem_kfree	call_site=0xffffffff982730, ptr=0x0, context.packet_seq_num=18, context.cpu_id=9, context_tid=522666, context_pid=522666
kernel	13:12:38.372 449 349	kernelchannel_11	11	kmem_mm_page_alloc	page=0xffffce850590d540, pfn=1459029, order=0, gfp_flags=17829322, migratetype=1, context.packet_seq_num=10, context.cpu_id=11, context_tid=522666, context_pid=522666
kernel	13:12:38.372 449 349	kernelchannel_12	12	power_cpu_idle	state=4294967295, cpu_id=12, context.packet_seq_num=16, context.cpu_id=12, context_tid=0, context_pid=0
kernel	13:12:38.372 449 349	kernelchannel_6	6	skb_consume	skbaddr=0xffff9237441e6400, context.packet_seq_num=16, context.cpu_id=6, context_tid=522650, context_pid=522622
kernel	13:12:38.372 449 349	kernelchannel_9	9	syscall_exit_writev	ret=72, vec=140737140158992, context.packet_seq_num=18, context.cpu_id=9, context_tid=522666, context_pid=522666
ust/uid/1000/64-bit	13:12:38.372 449 367	userchannel_5	5	jaeger_ust:start_span	trace_id_high=0, trace_id_low=4649323241996644491, span_id=2634666347856030036, parent_span_id=5383802249239795492, op_name=HTTP GET
kernel	13:12:38.372 450 746	kernelchannel_12	12	x86_irq_vectors_reschedule_entry	vector=253, context.packet_seq_num=16, context.cpu_id=12, context_tid=0, context_pid=0
kernel	13:12:38.372 450 746	kernelchannel_15	15	syscall_exit_clock_gettime	ret=0, tp=140427831834320, context.packet_seq_num=16, context.cpu_id=15, context_tid=1102987, context_pid=1102978
kernel	13:12:38.372 450 746	kernelchannel_4	4	writeback_mark_inode_dirty	name=(unknown), ino=9263312, state=7, flags=1, context.packet_seq_num=25, context.cpu_id=4, context_tid=522622, context_pid=522622
kernel	13:12:38.372 450 746	kernelchannel_5	5	syscall_exit_clock_gettime	ret=0, tp=140274797875488, context.packet_seq_num=22, context.cpu_id=5, context_tid=2231400, context_pid=2231378
kernel	13:12:38.372 450 746	kernelchannel_6	6	kmem_kfree	call_site=0xffffffff9098f79, ptr=0xffff923b63ee3800, context.packet_seq_num=16, context.cpu_id=6, context_tid=522650, context_pid=522622
kernel	13:12:38.372 450 746	kernelchannel_8	8	syscall_exit_clock_gettime	ret=0, tp=139859091850304, context.packet_seq_num=19, context.cpu_id=8, context_tid=522674, context_pid=522667
kernel	13:12:38.372 452 213	kernelchannel_12	12	x86_irq_vectors_reschedule_exit	vector=253, context.packet_seq_num=16, context.cpu_id=12, context_tid=0, context_pid=0
kernel	13:12:38.372 452 213	kernelchannel_15	15	syscall_entry_clock_gettime	which_clock=1, context.packet_seq_num=16, context.cpu_id=15, context_tid=1102987, context_pid=1102978
kernel	13:12:38.372 452 213	kernelchannel_4	4	writeback_dirty_inode_start	name=(unknown), ino=9263312, state=7, flags=1, context.packet_seq_num=25, context.cpu_id=4, context_tid=522622, context_pid=522622
kernel	13:12:38.372 452 213	kernelchannel_6	6	kmem_cache_free	call_site=0xffffffff909b3c2, ptr=0xffff9237441e6400, name=skbuff_head_cache, context.packet_seq_num=16, context.cpu_id=6, context_tid=522650, context_pid=522622
kernel	13:12:38.372 452 213	kernelchannel_8	8	syscall_entry_sendto	fd=17, buf=10788974232192, len=80, flags=16384, addr=0, addr_len=0, context.packet_seq_num=19, context.cpu_id=8, context_tid=522674, context_pid=522667
kernel	13:12:38.372 453 609	kernelchannel_11	11	x86_exceptions_page_fault_user	address=0x7fb7e7266000, ip=0x55af1a44da9a, error_code=0x4, context.packet_seq_num=10, context.cpu_id=11, context_tid=1102978, context_pid=1102978
kernel	13:12:38.372 453 609	kernelchannel_4	4	writeback_dirty_inode	name=(unknown), ino=9263312, state=7, flags=1, context.packet_seq_num=25, context.cpu_id=4, context_tid=522622, context_pid=522622
kernel	13:12:38.372 453 609	kernelchannel_6	6	skb_copy_datagram_iovec	skbaddr=0xffff9237441e7300, len=80, context.packet_seq_num=16, context.cpu_id=6, context_tid=522650, context_pid=522622
kernel	13:12:38.372 453 609	kernelchannel_8	8	kmem_cache_alloc_node	call_site=0xffffffff909a2dc, ptr=0xffff9237441e7000, bytes_req=224, bytes_alloc=256, gfp_flags=4197568, node=1, context.packet_seq_num=10, context.cpu_id=8, context_tid=522650, context_pid=522622
kernel	13:12:38.372 454 587	kernelchannel_15	15	syscall_exit_clock_gettime	ret=0, tp=140427831834320, context.packet_seq_num=16, context.cpu_id=15, context_tid=1102987, context_pid=1102978
kernel	13:12:38.372 454 587	kernelchannel_4	4	syscall_exit_read	ret=1, buf=140735976795678, context.packet_seq_num=25, context.cpu_id=4, context_tid=522622, context_pid=522622

Start Event

Kernel Events

Future Work

1. Root cause localization based on extended-spectrum analysis.
2. Using enhanced-differential flame graph to show the differences



Thank you!

Email:

maryam.ekhlasi@gmail.com

Source Code:

<https://git.eclipse.org/r/c/tracecompass.incubator/org.eclipse.tracecompass.incubator/+196496/4..5>